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approach

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TECHNOLOGY & SCIENCE

LCdr. C.J. Heatley from "The Cutting Edge," courtesy Thomas Soo Graphics, Inc.

Low-Level Flight High-Level Risk

Sometimes you have to go in low. Almost every combat aircraft flown by the Navy and Marine Corps has a tactical requirement for low-level flight. Whether it is over land or water, low-level flight is fraught with hazard.

When you're close to the earth, your margin for error is substantially reduced. You have to react quickly to obstacles, birds and other aircraft, terrain illusions and poor weather. Combined with a higher than normal workload, it can easily put the most experienced aviator in a box.

You can get good at low-levels, but you have to practice all the time. That's hard to do. If a squadron is trying to keep its cost per flight-hour down, it doesn't want to burn up gas on expensive low-levels. And sometimes when you have the money, you're deployed and you don't have the opportunity. It's hard to find good low-levels in the middle of the Indian Ocean.

Either way, it is a real challenge to all ops officers to keep their pilots current, etc.

This month, Approach offers a collection of articles about varying aspects of low-level flying in several communities in order to share some lessons learned and stimulate some discussion. If you think you've got a better story, let us hear from you.

LCdr. David L. Parsons
Editor

approach

Vol. 32 No. 3

Cover illustration of an A-4 Skyhawk on a low-level flight by Approach artist Blake Rader.

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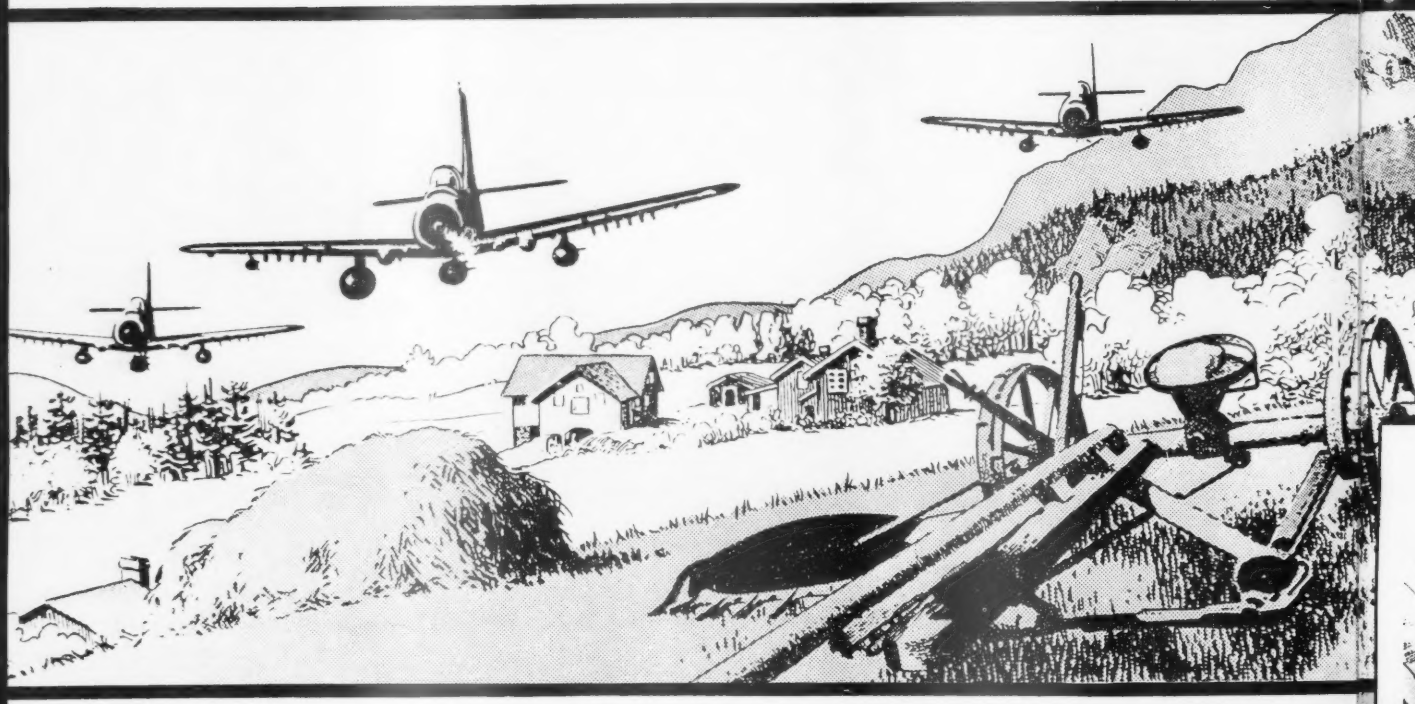
Long-range, low-level 1956



This is a condensed version of an article that appeared in a 1956 issue of Approach. Though 30 years have passed, many of the lessons contained therein still apply. — Ed.

THE first six hours of the flight were routine and uneventful . . ."

So begins the report of a recent fatal AD aircraft accident, the details of which highlight a significant, growing problem in naval aviation.

The current importance of long-range, low-level special missions, through which attack aviation has assumed a greatly increased striking power, has also brought with it some unusual conditions and problems not ordinarily encountered in flight operations. This brief of what began as a "routine and uneventful" flight is considered representative of many of the conditions which a low-level navigation flight may encounter.

For the pilot who is subject to flights of this or similar nature, there are answers which may be applied to the problems — but a thorough understanding of problems and answers is the requirement for *safe*, effective flight operations. Here, for the wise pilot is a cross-section of these problems and answers.

The Details. ". . . routine and uneventful." Penetration of the

Case 1: 2 ADs, flying over mountains on West Coast, attempted to climb through overcast . . . struck peak. . .

Case 2: The leader of the flight struck two of three power lines strung across lake. . .

coast was made after an hour and a half with all weather located well to the eastward of course. However, on the return leg, instrument conditions prevailed in this area from the coastline some 40 miles inland. Topography of this section was marked by mountainous terrain with peaks of about 4,000 feet, and winding valleys 2,000 or 3,000 feet below.

At this point the flight encountered a solid overcast which extended from 500 feet to an undeterminable height, obscuring valley areas as well as the tops of the mountains. Both pilots (pathfinder and wingman) elected to begin a climb while still VFR in an attempt to penetrate through an estimated clear layer of 1,000 feet, occurring about 7,000 to 8,000 feet. At 7,000 feet, penetration was begun at 160 knots.

It was then that the wingman called, "I have lost you; make a 180 and I will join up again." Leader acknowledged and began a port turn. After about 40 degrees of the turn, the wingman advised he had the leader in sight and to return to base course. Thereafter, no further transmission was heard, and after five minutes the leader attempted unsuccessfully to call the wingman.

Continuing to call, the leader proceeded the remaining 20 miles to the coast obtaining no answer from the wingman. The leader circled in a clear area near the coastline until low fuel forced his departure.

Later, the wreckage of the wingman's aircraft was discovered on a 3,500-foot hilltop near the area in which contact had been lost.

Although the exact cause was undetermined, the aircraft accident board considered the following possible causes — any combination of which could result in the loss of a pilot and an aircraft:

Continued

Case 3: Flight of two missed checkpoint, entered blind canyon. Wingman used flaps to climb out, pathfinder did not, crashed. . .

Case 4: Pilot's attention was diverted in cockpit . . . plane nosed down toward trees . . . power addition was too late. Aircraft mushed into ridge. . .

It was concluded that the wingman had exhausted the fuel in his external tank shortly after the rendezvous to penetrate the weather. The resulting loss of power and rapid shift from a fixed visual reference point (the other airplane) to instrument flying conditions could have caused vertigo. While fighting the vertigo sensation and attempting to restart the engine, a vapor lock may have formed in the fuel system. The apprehension caused by instrument conditions and loss of power combined to result in a rapid loss of altitude and the accident.

The Recommendations. The answers? The accident report and its endorsements make the following recommendations:

- All pilots flying low-level navigation missions be thoroughly briefed on all weather that might be encountered.
- When entering marginal weather, a shift to the best main fuel tank be effected immediately.
- Pathfinder aircraft should announce all weather to be encountered as soon as possible.
- A prearranged weather flying procedure should be established and followed when two aircraft encounter instrument weather and become separated. Rendezvous should not be attempted until in a clear area.
- All pilots involved in long-range, low-level navigation flights should be thoroughly briefed, at least quarterly, by the flight surgeon on the physical aspects of long flying.
- All pilots in training for this type mission should be given priority for instrument training, including weather flying prior to deploying.

The Need for Doctrine. At the squadron level there is the continuing need for adequate doctrine which, for example, will provide for a separate climb-through in instrument conditions.

New pilots must be made to understand that the practice of the old hands stressing seemingly minor details stems from experience which is costly when learned individually. Sooner or later every pilot receives a first-hand demonstration that the philosophy of "it-won't-happen-to-me" is a fallacy which can be fatal.

For those charged with the planning and scheduling of training, there is a significant relationship between the aircraft accidents of this type and the lack of instrument flying experience of the pilots involved. Insure the safety of your long-range, low-level flight operations with a long-term, ironclad policy of adequate training.

For the pilot, the squadron and the mission — these policies will pay rich dividends in lives saved, efficiency and effectiveness.

Low-Level Flight

High Level Risk

By Cdr. Richard Shipman

THE ability to fly low and fast is essential to tactical aviators, particularly the attack types. The recent A-6 raids in Libya showed the value of flying at altitudes low enough to avoid radar surveillance, thus achieving surprise at the target. Therefore, practicing and perfecting low-altitude high-speed (LAHS) flight is not only desirable, it is essential. But make no mistake; flying low and fast, in addition to being demanding, challenging and fun, can be dangerous.

Between 1980 and the first half of 1986, more than 80 mishaps have occurred during low-altitude high-speed training flights. Excluded from this total are mishaps that occurred in low-level flight, but were not related to the mission. Mechanical failures and inadvertently jettisoned stores are two examples. Significantly, the fatality rate is relatively high in the LAHS environment: 35 fatalities in the past five years. Clearly, 200 feet and 400 knots is an unforgiving environment.

Most fatal mishaps resulted from "collision with ground/terrain/water;" the pilot flew the aircraft into something immovable. Many of the mishaps occurred during low-angle weapons delivery. An AV-8 pilot had a mishap typical of this category while he was practicing 10-degree delivery of 2.75-inch rockets into rising terrain. Observers noted that the run was slightly steeper than the planned 10 degrees, and the terrain of the target was 360 feet higher than the terrain of the previous targets. The *Harrier* struck the ground during pullout, resulting in strike damage to the aircraft and fatal injury to the pilot.

Another common cause of Class A mishaps was stall and departure from controlled flight. The stall or departure is usually no big deal at 10,000 feet, but when it occurs at 1,000 feet, there simply isn't room to recover. An A-7 pilot found that out the hard way.

The lone A-7 was conducting a war-at-sea bombing mission against the wake of a DDG. After the last practice bomb delivery, the pilot recovered from the dive and leveled off at approximately 1,000 feet. He momentarily extended straight ahead and then rolled into a hard port turn. Witnesses observed vapor trails and wing tip vortices from the aircraft wings, indicating the pilot was pulling hard. After about 45 degrees of turn, the aircraft appeared to pitch up, slice to the left and then snap roll into a right spiral. The aircraft struck the water in a steep nose down attitude and a high rate of descent. No ejection was seen.

Several accidents have occurred on published VR and IR routes. One such accident involved an A-6E that was flying an unfamiliar route in a mountainous area of the west. Another aircraft notified ATC of black smoke emanating from a mountainous area near the route of flight. Search and rescue forces discovered the A-6 wreckage 1,500 feet below the summit of a ridge. No ejection had been attempted. Although the official cause of the accident was undetermined, the mishap board suspected that the pilot was operating his aircraft at high gross weight on a high altitude, unfamiliar route in mountainous terrain. They felt that he may have overestimated his *Intruder's* performance under these unfamiliar conditions.

Despite increased emphasis on flight discipline in recent years, that old bugaboo flat-hatting — still appeared as a cause factor in two of the Class A mishaps studied during the 1980 to 1986 period. Flying low-level nav missions on authorized routes provides naval aviators the opportunity to fly low and fast to their heart's content, and do it legally. Unfortunately, a small percentage of aviators choose to do their low and fast flying illegally, and they frequently pay for it with their wings or their lives. Such was the case with an A-6 crew on a cross-country flight.

The crew cancelled their IFR flight plan nearing their filed destination and proceeded to one of the crewmen's home in a nearby state. After several low passes over the house, the pilot attempted an aileron roll that he could not complete before the aircraft struck the ground. The crew was cited for poor judgment, lack of flight discipline and violation of the regulations pertaining to low-level flight. Continued

What are the rules governing low-altitude high-speed training flights? Weapons delivery flights usually require no special provisions because the bombing is done within sterile restricted areas. Low-level navigation flights are another matter, since waiver of several Federal Air Regulations (FAR) is necessary to conduct these flights, and the general public can become very irate as a 50,000-pound mass of metal, smoke and noise passes overhead unexpectedly.

Specific guidance for flying low-level VR and IR routes is contained in the Flight Information Planning (FLIP) Documents, Area Planning/IB. The High Speed Low Level Routes are described in detail along with minimum altitudes for each route segment, width of the routes, hazards and other information the low-level flier must know to fly the route safely. The days of blasting off VFR and dropping down to fly a low-level route at random have gone the way of cotton flight suits and brown flight boots.

In addition to standard route planning, these days starts with a phone call to the coordinating agency for the route (found in FLIP). A briefer updates the aircrew on items such as new towers or obstructions, noise sensitive areas on the route, unusual light plane activity in the area or any other hazards which aren't in the FLIP. This phone call, though seemingly routine, is crucial as the desired route may be closed due to an exercise or other cause unknown to the crew. The crew must then check the CHUM (Chart Update Manual — see page 14 for more on CHUM) to ensure the navigational charts they are using are current. The flight must be filed on the squadron flight schedule or on a DD-175 in a manner prescribed by FLIP.

Once airborne, the flight lead must contact the Flight Service Station nearest the route entry point to inform ATC of the flight's entry point, exit point and the times the flight will be at those points. The FSS specialist then puts the information on the appropriate VOR station to broadcast warnings to general aviation pilots transiting the area. When unable to contact the local FSS, a call in the blind is made to alert other aircraft. The specialist will also brief any pilots calling in for VFR advisories or flight following.

Interestingly, midair collision has not been a major cause of LAHS mishaps. In the 5½ years between 1980 and the present, there have been only two such mishaps. One occurred between two aircraft in the same flight as a section of A-7s entered a low-level route. The other occurred between an A-7 and a sailplane. Miraculously, the latter two aircraft landed safely and no injuries occurred. The other aviators didn't make it.

Even though the number of mishaps due to midairs has been small, the many near misses that are reported every year on low levels indicates that this is a major hazard associated with LAHS flight. The lack of accidents in the past is probably due more to luck and a good lookout doctrine than absence of threat. Remember, the low-level route, even when activated, is still VFR, and general aviation aircraft are free to use the airspace.

How about bird and wire strikes? Aren't they a major problem on low levels? Bird strikes certainly are. In the 5½ years studied, bird strikes were implicated in 35 Class C mishaps, four Class B mishaps and one Class A mishap. The good news is that although birds extract a high cost in damaged equipment and engines, they cause a major or fatal mishap much less frequently than the other categories of cause factors. Every squadron flying low levels should brief bird strike procedures and preventive measures before each mission.

Wire strikes have not been as significant statistically as bird strikes, but power lines and cables present an ever-present threat to the low-level flier. In flat terrain, man-made vertical obstructions are relatively easy to identify and avoid. But in mountainous terrain, power lines can be masked to the point of being nearly invisible. To compound the problem, there are smaller diameter, less visible grounding/static wires which span from tower to tower, often as much as 150 feet above the more visible high tension powerlines. Aircrews also need to be aware that the minimum altitude published for a route segment does not necessarily guarantee them altitude clearance from all wires.

What can the low-level flier do to make his LAHS training safer?

- Keep visors down and masks on. The only thing worse than a bird through the windscreen is a bird through the windscreen with this equipment not in place.
- Review articles on bird migration patterns to know when and where the greatest threat exists. (Weekly Summary addresses the threat prior to migratory seasons. See Weekly Summary 10-86).
- Plan the low-level route or delivery mission thoroughly. Be aware of route widths, altitude limits and obstructions along the route of flight. Review the CHUM to make sure your charts are current.
- If you stray off the routes or are lost, discontinue the exercise and fly the aircraft in accordance with applicable regulations. If you are no longer on a published VR or IR route, the speed and altitude exemptions may not apply. Also, you have no way of knowing about obstructions off the route. Climb and confess!
- Be gentle with your steed. Honking on the stick has few applications in flying, particularly at low altitudes.
- Be alert to target fixation. It's a problem with any weapons delivery but even a greater problem on low angle deliveries close to the ground.
- Be knowledgeable of minimum pullout altitudes to avoid shrapnel damage on low altitude weapons delivery and provide adequate terrain clearance.
- Adhere to the rules pertaining to low-level flight.
- Train to achieve proficiency in low-level navigation and maneuvering.

The last recommendation is not as easy as it sounds. Airspace limitations, traffic congestion, public complaints, ATC procedures and fiscal restrictions have all combined to make realistic and varied training more difficult. The problem is particularly acute on the East Coast, with its higher population and air traffic densities. All too often, mid-level IR routes turn into massive radio drills as the aircraft moves

Summary of Mishaps Related to Low-Altitude Flight*
1980 — 1986 (July)

Category	Class A	Class B	Class C	Fatalities	Remarks
Collision with Grd/Trn/Water					
During weapons delivery	11	0	1	15	
On VR/IR routes	1	0	0	2	
Failed to return to ship/base	2	0	0	3	
Unauthorized flight maneuvers	2	0	0	4	
Other	1	0	0	2	
Airframe Overstress	1	1	2	1	Class A — plt. pulled slats off a/c during low alt. pull up
Departure/Stall/ Uncontrolled Flt.	5	0	0	4	
Bird Strike	1	4	35	1	Fatal accident — bird strike induced assymetric ext. of slats, inducing uncontrolled flight
Mid-Air Collision	1	0	1	2	
Collision with Wires	0	2	1	0	Plt. strayed off published VR route
Aircraft Damaged by Ordnance	1	1	6	0	
Physical Incapacitation	1	0	0	1	
Totals	27	8	46	35	

*Mishaps not related to low-level mission excluded; i.e., mechanical failures, inadverent stores jettisoning.

rapidly from sector to sector in the low altitude IFR structure, making realistic training difficult at best. Efforts need to be made and perhaps TAD funds appropriated to allow LAHS training in lesser populated areas, including a variety of routes with varying terrain features.

Along with improved opportunities for low-level nav training, there is a need for low-altitude maneuvering training. As noted in the computer summary of low-level mishaps, numerous aircraft were lost because the pilot stalled or departed his aircraft at low altitude. Many other mishaps occurred while the pilot maneuvered at low altitude during weapon delivery flights, yet no training has ever been considered that involved high g maneuvering at less than 500 feet AGL — until now.

An exciting new training program is presently being reviewed that should do wonders to improve pilot survivability at low altitudes in a hostile environment. An Air National Guard unit flying A-7s in Tucson, Ariz. has developed a low-altitude training (LAT) syllabus designed to teach maneuvering flight as low as 100 feet AGL. At CNO's request, the Naval Safety Center conducted a risk assessment of their syllabus to validate the feasibility for instruction in Navy Fleet Replacement Squadrons. The Naval Safety Center's A-7 analyst, flying an A-7, and F/A-18 instructor pilots from VFA 106 and VFA 125 were enrolled in the LAT course. The program included training in the classroom, simulators and in the aircraft, flying in the Fallon operating areas. Maneuvers included rapid descents from altitude to 100 feet AGL, level and turning flight, +2 g maneuvering, vertical and oblique jinks and threat reactive maneuvers, including SAM breaks, all from 100 feet AGL.

Not all the maneuvers taught by the National Guard unit were deemed suitable for Navy FRS training, but the participants heartily endorsed the concept of formal training in low-altitude maneuvering. Approval of the program and many details still need to be worked out, but the concept offers great promise for improving low-level proficiency, survivability and safety.

Like many demanding environments in which Navy pilots fly, low-altitude high-speed flight has inherent risks. The key to reducing these risks is to be aware of what they are, develop ways to train, and then provide the funding and command attention to implement the training. Recent real-life hostile situations clearly indicated that low-level tactics will play an important role in many future conflicts. Naval aviators need to be ready to meet the challenge ◄

Commander Shipman, a former A-7 pilot, is a naval reservist on special assignment to Approach. He is a pilot for People Express Airlines.

Some Physics of Turning

—

Critical at Low Level

By Maj. Milt Miller, 162nd TFG
and
Col Grant B. McNaughton, MC, Directorate of Aerospace Safety

EVERY year, we see a number of collisions with ground (CWG) mishaps which lead us to believe that there may be an inadequate understanding of some basic physics of turning. A common pattern in many of our CWG mishaps combines *turning and looking* — turning at a high bank angle, and simultaneously looking at something other than the nose track relative to the horizontal. The closer you operate to the ground, the more important it is to bear the following points in mind.

- To start a level turn, the nose track needs to be visually cross-checked to ensure the nose doesn't drop.
- To maintain a level coordinated turn, the number of G must equal

$$\frac{1}{\text{cosine bank angle}}$$

as shown in figure 1. (This is based strictly on lift; no allowance is made for vertical side forces generated by the fuselage and tail at high bank angles.) For example, a level 60-

G REQUIRED FOR LEVEL FLIGHT
BY BANK ANGLE AND TOTAL G

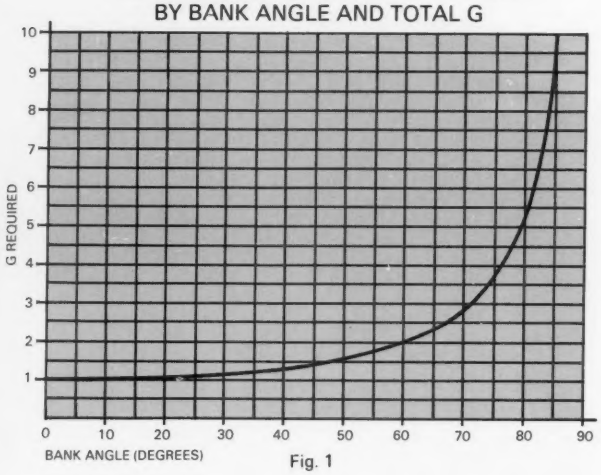


Fig. 1

degree banked turn requires 2G, 70 degrees about 3G, 75 degrees about 4G and 80 degrees about 6G. Note also that at 85 degrees, over 11G is required, and that at 90 degrees, the number is theoretically infinite.

• If the G is insufficient to maintain a level turn, the pull of gravity will cause the aircraft to fly a descending path. The formula for the altitude lost or distance (d) is: $d = 16.1$ (G multiplied by the cosine bank angle minus 1)t^2, where G = G on aircraft, and t = time in seconds. Figures 2, 3 and 4 are based strictly on this formula; they make no allowance for changes in velocity vector.

• If a turn is unmonitored, it is very easy to overbank. Whereas 2G will hold a level 60-degree bank, if you inadvertently overbank to 70 degrees while holding only 2G, figure 2 shows you will lose 200 feet in less than 6.3 seconds. If you inadvertently overbanked to 80 degrees while holding 4G (sufficient to hold only 75 degrees), you'd lose 200 feet in under 6.4 seconds.

Figure 3 shows what happens when G are held constant (in this case two), but bank angles exceed 60 degrees.

Figure 4 shows the effect of a constant bank angle (in this case 80 degrees) with insufficient G.

• Note in the foregoing the importance of time: Altitude lost is a function of *time squared.* By the end of the third second, you will have lost nine times the altitude as at one second; by the end of the fifth second, 25 times the altitude as at one second.

• Whereas altitude AGL provides some safety margin while wings level, the margin evaporates when turning. See figure 5 to compare times to impact (TTI) from our common "step down" altitudes with a one-degree wings level descent vs. step overbanked turns. Doubling air speed halves the TTI in the wings level descent, but airspeed has a negligible effect on TTI from overbanked turn, until you bank significantly

BANK ANGLE vs G CURVES
ALTITUDE (AGL) BY SECONDS ELAPSED
STARTING ALTITUDE — 1000 FEET

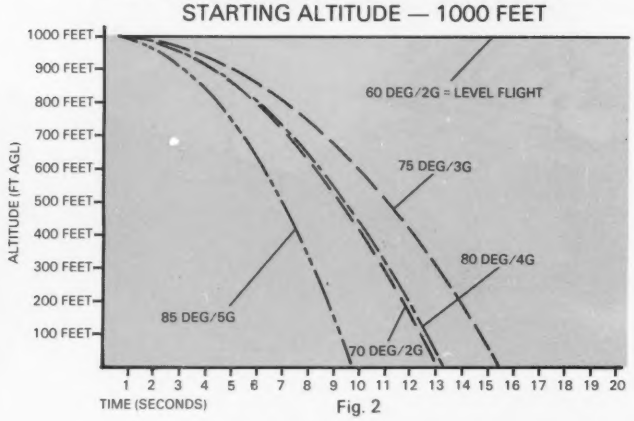


Fig. 2

BANK ANGLE vs 2G CURVES
ALTITUDE (AGL) BY SECONDS ELAPSED
STARTING ALTITUDE — 1000 FEET

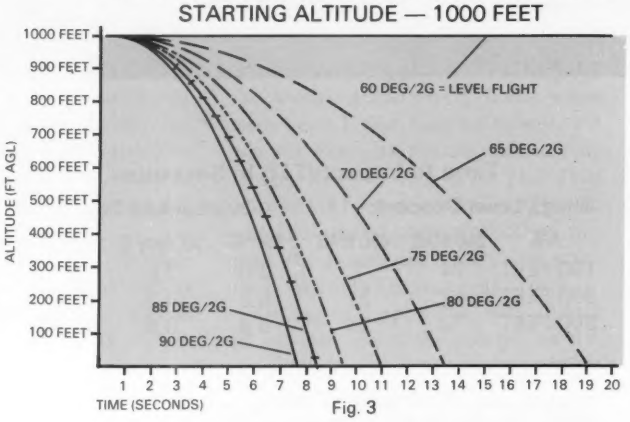


Fig. 3

BANK ANGLE = 80 DEGREES vs G
ALTITUDE (AGL) BY SECONDS ELAPSED
STARTING ALTITUDE + 1000 FEET

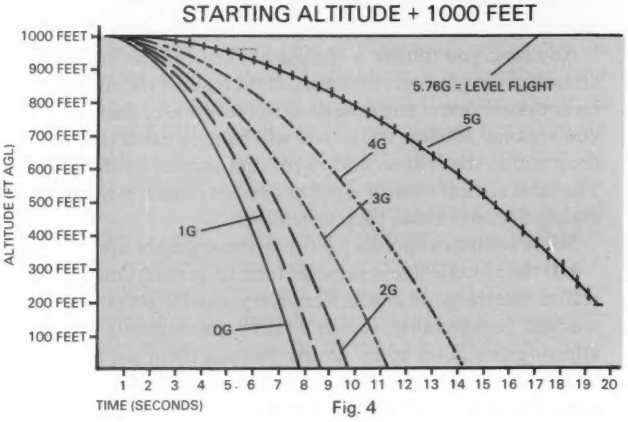


Fig. 4

Time to Impact (TTI) In Seconds

Wings Level Descent: -1°			Overbanked Turn		
AGL	240 KIAS	480 KIAS	85°/4G	90°/any G	95°/5G
100 FEET	14	7	3.0	2.5	2.1
300 FEET	42	21	5.2	4.3	3.6
500 FEET	70	35	6.8	5.6	4.5

Fig. 5

past the vertical and continue pulling positive G.

From the above, note what happens on a level break turn using 90 degrees bank from 100 feet AGL: one-potato, two-potato, three-po — crash! From five times that altitude AGL, the time to impact is only slightly over twice as long. What happened to all that safety margin?

Any time you initiate a steeply banked turn at low AGL altitude, snap your eyes forward out the front of the aircraft to immediately detect any nose drop to the inside of that turn. If you are only 100 feet AGL, you will have to catch that nose drop within the first second to prevent impact by the third. The most critical control input to prevent impact is to immediately decrease bank, then increase G.

Some additional points regarding these graphs are:

- If the altitude lost represents time to impact, you should realize that the point at which recovery is no longer possible is reached considerably sooner. There are multiple factors affecting this point of no return. Among them are velocity vector; angle of attack; roll rate; G available; airspeed; aircraft weight, CG and symmetry; density altitude; changes in terrain elevation and pilot reactions.
- At 90 degrees of bank, you fall like a rock, regardless of G. Past 90 degrees, with positive G, you are directing your lift vector toward the surface; you'll get there ahead of the rock.
- Note that airspeed is not a player in how fast you fall with insufficient G for your bank angle until you roll past the vertical. It does, however, affect the impact point, as well as such factors as G available and turn/pullout radius: Faster movers go farther while falling, and though they may have more G available, use up more room turning or pulling out.

To recap, turning and looking at something other than your nose track can get your nose started down and can lead to overbanking. Overbanking (turning at high bank angles with insufficient G) loses altitude. The amount of altitude lost is a function of the square of the time at that high bank angle. Time is therefore critical.

Unfortunately for us humans, our sense of time is not particularly accurate nor even constant. Sometimes it runs a little fast, sometimes a little slow. As a rule, when we are concentrating on something, distracted either inside or outside the cockpit, excited, stressed, preoccupied or otherwise having a good time, it's safer to assume that time flies. Like one of Murphy's Laws, things always take longer than you think. Judging from many of our CWG mishaps, pilots sometimes do allow themselves to become inattentive to their flight path for excessive periods of time.

While turning at low altitude, you may have only a second or so to prevent CWG. **Turning and looking at low level is a death act**. There simply is no margin for that kind of error.

Adapted from *USAF Flying Safety magazine Sep '83.*

Out of Gas and Nowhere to Go!

By Lt. Mike Bowers

. . . The nearest acceptable divert was 200 miles away. We didn't have the gas to make it . . .

IT was a typical FRS training hop, if you can call a night low-level through the Cascade Mountains of Washington and Oregon "typical." The syllabus called for a night/IFR low-level flight ending in a run through the target range for bombing practice. The night flight was preceded by exactly the same hop flown in day/VMC conditions.

My instructor pilot and I completed the day hop with no problems; that is, none that are not expected from a brand new A-6 B/N on a difficult low-level navigation hop. I had planned the flight in accordance with all syllabus requirements and felt very confident that all would go well. The fuel would be critical. We would not have much time to play around in the target area, but we knew our bingo fuel from the target area and were returning to NAS Northwest, which was always open.

During the day hop, we were tight on fuel and made only two runs in the target area, having burned a little more on the low-level than expected. Upon completion of the evening's brief, we were ready to man up our Intruder. The only fact of note was the less-than-optimum weather expected at homeplate upon our return. The forecast called for 300 and ½ — not great, but above minimums. The weather at our alternate, a nearby Air Force base that we always used as our standard divert, was considerably better.

The next closest alternate was on the other side of the mountains, about 30 minutes of flight time away. The low-level weather was IFR but above route minimums, and after all, our mission is "all-weather attack."

Our launch and flight to the entry point were uneventful. In fact, we were doing better on fuel than expected. Once on the route, our full attention was focused on keeping our bomber clear of terrain. At each turn point we checked our fuel. We were still doing better than we had during the day. We attributed this to the conservative low-level flying we were doing, none of the yanking and banking common to a day mission.

When we reached the target, we made several runs and were ready to finish up with a "high loft" (basically a ½ Cuban 8). We still had 7,500 pounds of fuel, plenty for the return to base. Recovering from the maneuver, we checked all our instruments prior to departing the range. A quick check on fuel . . . holy s---! Apparently our fuel gauge had malfunctioned and the four "G's" we had just pulled corrected the problem. Our real fuel state was 4,500 pounds and we knew that we were now looking at a bingo profile back to homeplate. I was not overly concerned since my pilot had a great deal of experience, and we were within bingo range of our base and the alternate.

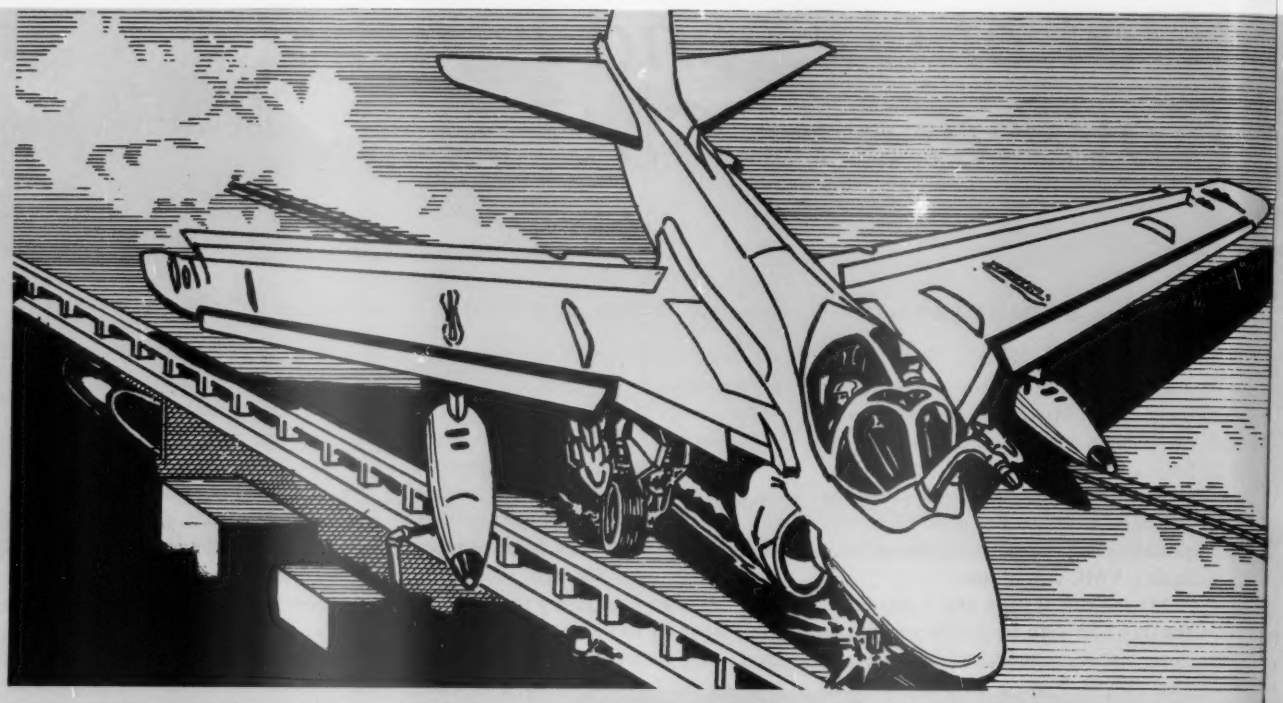
Upon checking with NAS Northwest approach, we were told that the weather had deteriorated to PAR minimums. No aircraft had taken off for some time, but being aggressive young men of the sky, we went for it. Our fuel was low, but if we were unsuccessful, there was always our alternate a mere 10 minutes of flight time away. Our first approach was waved off at 200/1/2; we simply couldn't see the rabbit lights. We went back into the pattern for a second try. We were still above the divert fuel.

At this point a little bit of training command basics came to mind, so I gave approach a call and inquired about the weather at our divert. It was worse than here! It was hard to believe, but our Air Force base divert was actually closed. Now we were in the proverbial hurt locker. *Out of gas and no place to go!* The nearest acceptable divert was over the mountains nearly 200 miles away. We didn't have the gas to make it.

On our next approach, with all four of our eyes out of the cockpit, we discerned the runway environment and got the airplane on the deck.

In the cool light of day, our major mistake was obvious: not checking divert weather conditions as soon as we knew that the weather at homeplate had degraded below forecast. When planning any type of flight with the weather at your destination questionable, you should have more than one alternate, especially if your primary one is close to your destination. This valuable learning experience cost no more than a few agonizing moments in the cockpit (and at the duty desk for the squadron SDO), but other flights haven't ended as well. Always be aware of fuel planning and don't have undying faith in the weather forecast. If they are calling for "bad," expect "worse." ◄

Lt. Bowers is a B/N with VA 95, an A-6E squadron based at NAS Whidbey Island, Wash.



Intruder Lessons. The East Coast Intruder community has had three recent incidents involving emergencies immediately following initiation of the cat stroke. There is a lot to be learned from each of these incidents about crew coordination, ship support and general knowledge of your aircraft.

The first mishap resulted in the loss of a KA-6D with a fodded engine and in-flight fire stemming from a severed nose strut, but its crew successfully ejected.

The last two incidents were similar since they also involved failure of the lower portion of the aircraft nose strut. But the sequences of these two mishaps were quite different.

Launching for a simulated night strike, a VA 176 A-6E crew felt a normal stroke, and the B/N; LCdr. Michael Rowland, observed 130 KIAS. At the end of the stroke, the crew heard a loud explosion, accompanied by a bright flash.

As the pilot, LCdr. Scott Beaton, rotated the aircraft, he immediately jettisoned his external stores, with the angle of attack (AOA) indicator at 23 units. The VDI presentation was noted to be frozen in pitch and roll, but the engine indications were normal. The A-6 held a constant 100 feet MSL, accelerating, as the pilot first levelled off, then climbed for increased altitude. Passing through 1,000 feet, both crewmen noted decreasing airspeed, and the B/N called for the pilot to "nose it over." The pilot saw an AOA of 30 units and airspeed decreasing through 100 knots. He applied forward stick, and the aircraft accelerated to 150 KIAS, with an AOA of 21 units.

He started another climb to 2,000 feet with 22 units AOA. As the airspeed accelerated through 200 KIAS, the pilot raised the flaps, and the crew observed stable indications. The ship told them to climb to 7,000, where another A-6 could look them over. The second A-6 saw the nose gear severed below the drag brace, and the first Intruder diverted to a nearby NAS for a straight-in, arrested landing.

During the third incident involving nose gear, a VA 35 A-6E crew manned up for CQ operations. Their aircraft was loaded with a D-704 aerial refueling store, two 300-gallon droptanks, two MERs and a fuel load of 9,000 pounds. During the cat stroke, the lower nose strut failed, separating from the aircraft, which pitched up dramatically. The Intruder came down on the remaining upper half of the strut, with engines at full power, and slid down the No. 1 cat, angled toward the starboard catwalk.

The pilot, LCdr. Bill Shewchuk, immediately retarded both throttles, applied brakes and extended the speed brakes, as the B/N, Lt. Greg Atchinson, monitored the aircraft's speed and movement across the flight deck. The A-6 finally stopped when the starboard main gear contacted the ship's deck combing, approximately halfway down the track.

AIR BREAKS

In both cases, the crews were prepared, having been briefed on the first mishap involving the KA-6D. They were ready for a catastrophic failure during the cat stroke, one of the most dangerous times during the entire carrier and flight deck evolution. In the VA 176 incident, the crew got the plane airborne while the mini-boss transmitted "Jettison, jettison." Aided by this alert call, the crew was able to clean up and fly their crippled aircraft, stabilize their situation and eventually bring their aircraft to a safe arrested landing ashore.

Dead Right? The TH-57 was on a training mission in the busy southeast. The helo crew called for traffic advisories and requested a low approach. The local radio acknowledged, and reported one civilian twin in the pattern and a Huey turning on deck.

On final, the TH-57 instructor saw the twin on downwind and accelerated to 100 knots while maintaining the runway centerline. The instructor heard the twin pilot call short final, at which time the twin passed directly over the helicopter, with less than 100 feet vertical clearance. The private aircraft then landed directly in front of the helicopter, whose pilot had to execute a quick stop to avoid the civilian.

The ground radio operator had been talking with both aircraft, and when he asked the civilian pilot if he had seen the Navy helo on final, the twin's pilot replied, "Yes, but helos have to remain clear!"

The oft-quoted phrase, usually related to automobile driving, "You can be right, dead right!" can certainly be used here. As the helicopter training squadron's commanding officer said, the fact "that a pilot would deliberately place two aircraft and flight crews in extreme jeopardy over a question of right of way is incomprehensible . . ." The twin pilot was also wrong, nearly dead wrong. —Ed.

H-2 in the Fog. The Seasprite had been airborne for 90 minutes on a dawn SSSC hop. Although forecast to remain VFR, the weather began to deteriorate, with fog developing throughout the area. The DD recalled the helo and set flight quarters for the recovery. Twenty minutes later the H-2 was over the ship, but the fog had intensified and visibility was down to zero.

With no divert possibilities, the ship and the aircraft crew decided on an emergncy, low-visibility approach. The helo's co-pilot spotted the ship's wake at 100 yards, just at the missed approach point. The flight deck appeared at about 50 yards, and a safe recovery followed.

The crew of the HSL-35, Detachment 1 Seasprite (Lt. C.W. Sproul, HAC; Lt. R.W. Wehrwein, co-pilot; AW3 R.M. Kerner, aircrewman) and the ship's aircraft controller, OSC J.A. Gilley, exhibited the kind of coordination between crew and ship that is necessary to get through a bad situation. Four years ago, though, an H-2 assigned elsewhere was lost in similar circumstances. The difference between causing and preventing mishaps is very often the prompt realization of an extremis condition and taking positive action. For more on this type of operation — foggy, foggy dew — see "Out on the Tip of the Sword," Approach May 86.) — Ed.

Night Ditching in an SH-3. An SH-3 flying a night low-level ASW mission was shaken suddenly by intense vibrations which bounced the sonobuoys out of their tubes. The personnel door flew open and the instruments became completely unreadable due to continuing vibrations.

The co-pilot secured the two hydraulic servo systems and informed the HAC. The procedure had no effect and the helicopter was rapidly becoming uncontrollable. The co-pilot broadcast a Mayday while the HAC told the crew to prepare for ditching.

As the HAC began a descent, the vibrations ceased, but the SH-3 yawed 50-60 degrees right as the tail rotor finally failed. The co-pilot quickly secured the speed selectors. The HAC initiated an autorotative flare at 100 feet. At 60 feet, he leveled the nose and cushioned for impact.

The helicopter hit the water and rolled over. The crew egressed safely.

This HS 12 crew off USS Midway (CV 41) exhibited excellent crew coordination and situational awareness during one of the most demanding emergencies that a helicopter crew could face: a night ditching, with no visible horizon and tail rotor failure. — Ed.

Low Oil Pressure in a C-12. The C-12's scheduled maintenance check flight had been delayed at the request of the contract maintenance field representative. While performing maintenance for high oil pressure readings, he had found the left engine's oil pressure at zero during the ground turn-up. During the hour's delay, he corrected the discrepancy and released the aircraft for flight.

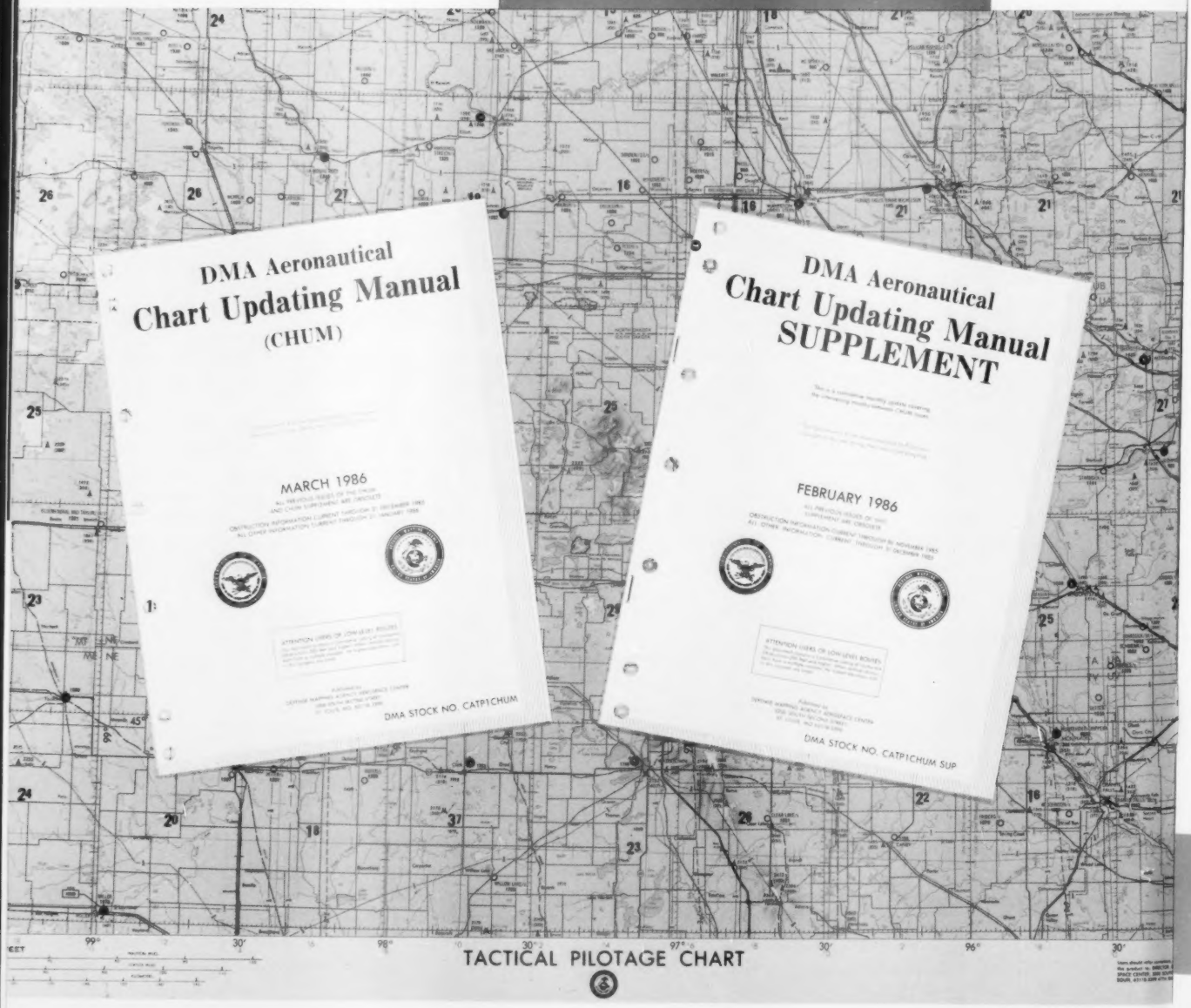
Forty minutes into the check flight, the right engine's torque began fluctuating, the prop rpm decayed and oil pressure was lost. The crew secured the engine and declared an emergency, making an uneventful single-engine landing back at their base.

Post-flight inspection revealed the snap ring retainer of the oil pressure regulator was not properly seated. It was out of position, causing oil starvation to critical engine parts. It was also discovered that the left engine's loss of oil pressure during the preceeding ground turn-up had been due to the same error, and the aircraft should never have been released for flight.

Though the mechanic was removed, the one moment of inattention to detail could have caused a major mishap.◄

The CHUM

By David Caldwell



"THE job isn't finished till the paper work is done." This popular commentary is understood by most of us. It prompts us to attend to tasks that are required but often approached with little enthusiasm.

Consider this expression: "Flight planning isn't finished till the CHUM has been checked." Though somewhat less popular, this little reminder is significantly more relevant to military aircrew members. The consequences of treating it lightly are severe. The rewards for abiding by it include the life of the pilot and crew. Military aircrews routinely bet their lives on the currency and accuracy of Defense Mapping Agency (DMA) aeronautical charts.

To emphasize the significance of the quoted expression, here are some basic facts about the CHUM (Chart Updating Manual).

The DMA provides aeronautical charts to all military flying organizations. They are produced initially to satisfy a specific operational flying requirement and then are updated periodically through publication of newer editions. Unfortunately, it is not possible to publish updated charts fast enough to keep pace with all the changes that occur worldwide. DMA constantly reviews new source materials. Many changes to chart features are noted daily (new vertical obstructions, new powerlines, new airfield data, etc.).

A method of communicating these day-to-day changes to military aircrews is accomplished with the CHUM and the CHUM supplement. These monthly publications provide military aeronautical chart users with corrections, data about hazardous conditions not previously known and new currency information.

The CHUM is published in March and September of each year and contains a complete listing of known aeronautical chart correction information. The CHUM Supplement is published monthly between editions of the complete CHUM and contains a cumulative listing of additional changes and corrections. These two publications, along with Flight Information Publications (FLIP) and Notices to Airmen (NOTAMs), should be reviewed by crew members prior to each flight in which aeronautical charts are used.

The CHUM/CHUM Supplement are divided into sections. The cover contains three relevant dates. A publication date appears near the center of the page. Below it are the information currency dates, one for obstruction information and one for all other information in that publication. It is important to locate and reference the latest edition CHUM/CHUM Supplement and to understand the currency of information published.

After a table of contents, each CHUM/CHUM Supplement contains one or more pages of general information under Section I. In order to make effective use of these publications, you must read and understand the information provided there. Section I provides instructions for reporting uncharted obstructions and describes the criteria used for including chart corrections in the publications. A "Summary of Changes" paragraph keeps you informed on changes to the CHUM/CHUM Supplement itself, and the "General Notices" paragraph gives broad category information on aeronautical charts. A request for user response and a legend round out the section. The information in Section I may change from time to time, reflecting changes in the data provided, format or method of using the publications.

Section II contains correction data for aeronautical charts. The listed charts are arranged by series or type, then in alphanumeric order by chart number. Corrections to each chart are listed by one-degree blocks of latitude and longitude, beginning in the upper left corner of the chart and progressing left to right from top to bottom. This arrangement is designed to assist you in locating and transferring the corrected information from publication to chart.

It is essential that you match the chart in use with the one listed in the CHUM/CHUM Supplement. This match is not only by chart number but by edition number and date as well. If all numbers do not match, the chart and the CHUM cannot be used together.

It is significant to note that corrections listed represent those that are known to DMA. There is no intent to imply that each chart is systematically examined to identify all discrepancies which may occur. Once a correction appears, it is carried in each subsequent CHUM and CHUM Supplement until the chart in question is obsolete or replaced by a new edition.

All charts published and available are listed in the CHUM even if no corrections are required. This listing provides military aircrews with a handy reference for confirming the chart they are planning to use is, in fact, the most current chart published by DMA.

Safety of flight is a main concern and DMA is dedicated to providing aeronautical chart update information in the most timely and usable way. The CHUM/CHUM Supplement are regularly reviewed to determine if proposed changes will improve the publications' utility. If you have suggestions for improving the CHUM/CHUM Supplement, or if you have a question regarding these publications, please contact the DMA Aerospace Center, ATTN: PRN, 3200 South Second Street, St. Louis, MO 63118-3399.

And remember — "Flight Planning isn't finished till the CHUM has been checked."

Mr. Caldwell is with the Defense Mapping Agency's Aerospace Center in St. Louis, Mo.

Is Your Scan U

By Lt. Rick Dubois

Up to Speed?

AFTER a low-level through the French Alps, my wingman told me he was impressed with the way I had avoided a helicopter hidden behind a ridge. After he had perfectly described my maneuver over the ridge, I asked, "What helicopter?"

We talked about it for a couple of minutes, and I concluded that our EA-6B crew needed to be looking outside the cockpit a bit more. After a few more flights it became apparent that we also had to define our specific areas of responsibility, even though we have four sets of eyeballs keeping us in line. A review of lookout procedures can usually be traced back to that point when the briefer says, "Below 10,000 feet everyone, should be looking outside." After climbing through 10,000 feet, most folks go about their business, and lookout doctrine becomes the responsibility of the front-seaters. Perhaps it's that way with your crew.

When briefing a VFR scan with your crew, there are a couple of possible situations to consider. The first is the low-level flight environment. The pilot's scan is primarily forward of the aircraft, going from 9 to 3 o'clock. The right-seater generally scans the same area, although he spends a bit more of his time adjusting the radar, updating the nav system and flipping the chart trying to convince the pilot that the aircraft really is where it should be. When the right-seater has his head in the cockpit, the pilot and guys in the back seat must cover his area of visual responsibility —because that's when you usually meet the unexpected!

The guys in the back seat may be thoroughly convinced that the front seat knows where they are headed, and all must be clear ahead. The fact is, unless the pilot has an incredibly good scan, there may be a huge blind spot starting at about the 10 o'clock position and working its way counterclockwise to the 2 o'clock position. Quite a sizable chunk of sky for an unseen aircraft to be in. Therefore, the back-seaters need to develop their own VFR scan and be ready to call out any traffic.

The second interesting situation occurs when flying in formation. That's when lookout doctrine relaxes a bit because supposedly, nothing can get past eight sets of eyeballs. In this situation, everyone may be under the impression that the lead aircraft has thoroughly scanned the skies and all is clear ahead. The pilot of Dash Two is generally locked on to the lead. His scan is just about useless, and even less so when maneuvering. This pilot can be counted upon to clear the airspace that lies on the other side of the lead, and that's about it. The right-seater needs to take this into consideration when deciding where to look. Although he is interested in formation integrity, he should be looking at all areas forward, covering what his pilot cannot see.

The last situation is the VFR recovery back at the ship. Let's face it — the thought of 20 aircraft all flying VFR in the same general area is enough to make anyone nervous. Differing types of aircraft are entering the same airspace at different speeds and altitudes. All eyes capable of scanning the skies need to be doing just that. Once established in the marshal stack, contact needs to be maintained with those already established, in addition to those stragglers who are still entering the pattern. Flying the familiar left-hand pattern, it becomes obvious that the pilot can see everything to the left of the aircraft and absolutely nothing to the right. Those on the right-hand side of the aircraft must maintain a lookout that clears airspace to the right.

Are you confident that everyone is covering his particular area of responsibility? If not, you may be flying in a tight area with a continuous 180-degree blind spot.

Before you crawl into an aircraft, take the time to define your lookout doctrine. We tend to assume that with a multicrewed aircraft, we can become just a bit more lax; the other guy will probably see it if we don't. All briefs need to cover a well-planned and clear-cut lookout doctrine that everyone understands before anyone's scan is truly up to speed. ◄

Lt. Dubois is NATOPS officer for VAQ 137, an EA-6B squadron based at NAS Whidbey Island, Wash.

FIRE AT MIDNIGHT

By Lt. Peter J. Canalichio

It was 2330 local time, we were over 850 miles west of California, at 3,000 feet in and out of clouds. My crew had been notified at 0730 that we were in line for a tactical mission that neither my crew nor squadron expected. We were eight hours into that mission when instructed to stay until mission completion or prudent limit of endurance. I had loitered the No. 1 engine upon arriving on-station five hours earlier. Now I was seriously considering two-engine loiter to increase my on-station time.

The flight had gone smoothly up to that point. Then the flight engineer told me that the No. 3 engine oil pressure was fluctuating wildly. I now had only half the normal oil quantity. I checked the engine and reported to my TACCO the need for a safety-of-flight abort. "Aft observer, stand by to start number one," I called. There was no immediate answer. "Aft observer, stand by to start number one, now!"

"Standing by number one," was the reply.

"Roger," I said. "Flight engineer, start number one."

After he called normal start on No. 1, I asked him to recheck No. 3. The indications were the same. "OK," I replied, "feather number three. HRD (high rate discharge) not required. Emergency shutdown checklist." My flight engineer feathered the engine and my co-pilot began reading the checklist.

At the second step the starboard aft observer called, "Fire on number three! Fire on three!" My cockpit fire warning light illuminated and the horn sounded. We were tired before, but wide awake now.

The aircrew began securing non-essential electronic equipment and positioning Imperial wet suits in anticipation of a night ditch. By rote, I called, "HRD number three. Emergency shutdown checklist." My flight engineer discharged the fire extinguisher on the burning engine and cancelled the warning horn at my direction. The light didn't even flicker, and the co-pilot reinitiated the checklist. When he read the third item ("If engine fire still persists") I checked to see if No. 3 was feathered, and called back to my observer for indications. "It's still burning! There are flames coming out of the tailpipe." I acknowledged and directed that the checklist be continued.

"Oil tank shutoff valve circuit breaker," the co-pilot responded. Having already determined that the propeller was feathered and that the fire continued to rage, I directed the engineer to set the oil tank shutoff valve circuit breaker, securing oil to the engine. I again asked the aft observer the status of the fire. He reported the flames were dissipating, but the turbine was still glowing. Seconds later, the fire warning light went out. I began to breathe easier.

Turning east, I started a climb toward home base. As my airspeed dropped off slightly the starboard aft observer reported excitedly, "There are flames coming out of the turbine again!" On came the fire warning light in the flight station and the horn began to sound.

My throat became very dry and my mind started racing. Standard operating procedures no longer worked. Would I have to ditch? Would I have enough time? Would I have to initiate bailout? Thinking furiously, I pushed these ideas away. I needed to think! How was I going to get rid of this fire and bring my crew back home safely?

Up to this point, all indications were that the fire was contained in the turbine section of the engine. In addition, my first high-rate discharge bottle gave no indication that it was having any effect on the fire. The only positive indicator that the fire was diminishing came when setting the oil tank shutoff valve circuit breaker.

All indications pointed to an oil-fed fire contained in the turbine section. Reflecting back on my own COMNAVAIRPAC NATOPS check flight, I remembered being presented the same scenario a few months earlier. The evaluator

emphasized that since the fire was in a section of the engine not covered by the extinguisher, the subsequent discharge of extinguishers would be ineffective. He also stated that possible solutions included blowing out the fire by raising the airspeed or attempting to climb to an altitude high enough to starve the fire of oxygen.

I decided not to discharge my second HRD bottle. I still had 850 miles to transit and felt certain that the fire extinguisher would not help. Maintenance investigation later confirmed this. At 4,000 feet, I was too low to try to climb to put out the fire. Besides, that was how the fire originally reflashed. Therefore, all I could do was add power, push the nose over into a descent, and attempt to blow out the fire.

At 250 knots, my aft observer stated the fire was diminishing. As the airspeed increased through 280 knots, the fire finally extinguished. Fearing a reflash, I maintained airspeed and began a shallow climb until I felt certain the fire would not reignite. The observer remained posted, and all fuel crossfeed was discontinued for the rest of the flight.

Now that the major problem was corrected, I concerned myself with the next challenge, a night three-engine landing at NAS Moffett Field. Aware that we had an emergency, air traffic control gave us direct routing. The forecast weather was clear and the runway dry. We made an uneventful landing.

A post-flight AIMD investigation determined the probable cause of the engine fire to be a coked scavenge oil line causing excessive back pressure, which in turn caused the diffuser to be filled with oil. The expander rings on the turbine lighthouse assembly further forced this oil into the combustion chamber where it ignited and caused the fire. The fire was contained within the combustion chamber turbine and tailpipe areas. The engine was "high time," having accumulated 10,979 hours since overhaul and 12,312 total hours. Post-flight investigation further confirmed that the HRD discharge was ineffective, because the fire was located in an area that the HRD system is not designed to protect. A second HRD discharge would have been equally ineffective. ◄

Lt. Canalichio is in training at the U.S. Naval Test Pilot School, Patuxent River, Md. A 1981 Naval Academy graduate, he previously was pilot training officer in P-3Cs with VP 47.

TERRAIN ILLUSIONS

A Plug for ROE

By Lt. J.D. Webster

Jinking to the right, I crossed behind my skipper's A-7 as he came hard left off the target. I got a good view of the Mk-76s going off in the revetments of the target airfield. Good hits! Now where was that A-4 adversary we saw a moment ago? As the skipper egressed west, I slid into a perfect combat spread on his right wing. Together, we raced along the rocky desert valley floor at 500 feet. We zipped up a ridgeline and popped over the crest. The skipper rolled inverted, pulled down hard, then adjusted his bank, turning the maneuver into a high "G" TAC turn to the north. Not quite as skilled as the skipper, I floated over the ridgeline, hanging a little too high.

A threat radar lit off my EW gear for a second. Distracted, I was late starting my turn. Rats! As the skipper passed under me, I overbanked and pulled my nose down into a hard diving turn determined to catch up. We were entering a low valley between two mountain ridges as part of our planned egress route. I checked my position; in a few seconds I would be back in formation.

What was that? I thought I saw that wiley A-4 again. Still descending, I craned my neck around and stared hard over my right shoulder. The skipper was several hundred feet below me. I could see him in my peripheral vision. Then, incredibly, my radar altimeter went off. Instantly, my eyes came forward. I was in a 10-degree dive passing 400 feet AGL and in front of me was an unbelievably large rock, several, in fact. Horrified, I watched the rock grow larger as my body sagged under the eight "G" load from my instinctive pull on the stick. In slow motion the radar altimeter continued to unwind, 200, 150, 125. Oh, mother, I'm gonna die!

I sat, frozen with shock, as my Corsair clawed back to the safety of high altitude. I felt betrayed. I had felt safe, with plenty of sky under me as I dove to catch the skipper. What went wrong?

I had been tricked by a "terrain illusion." In our TAC turn to the North I had crossed to the skipper's left side. He was flying at 500 feet over the center of the valley and our formation had placed me into the rising slopes on the far side. I was several hundred feet above my lead . . . but not the rising ridgeline I almost hit. I was "belly up" to the slope, and in looking out over the valley floor I perceived myself to be about 800 to 1,000 feet high.

I owe my life to that skipper, because he briefed all pilots on this low-level training strike to use a 500-foot radar altimeter setting. I was a new guy with very little experience and did not recognize many of the dangers of flying in rough terrain. Given an option, I would have had my radar altimeter set at 200 feet (the minimum altitude for our laydown bomb attack) and would have died. We all recognize that low-altitude flying is dangerous. AIRPAC's ROE (rules of engagement) are established with a 500-foot minimum altitude so that, in training, a safety cushion can protect us from such errors.

. . . Horrified, I watched the rock grow larger as my body sagged under the eight "G" load from my instinctive pull on the stick . . .

Now, two years later, with over 100 low-level missions under my belt, I can recognize those low altitude terrain traps. You're probably a star, too, but what about that eager nugget on your wing? Give him a chance to become good. ◄

Lt. Webster is currently assigned to VT 4. He flew the A-7E with VA 195.

Night Vision or Night Fright

By Capt. M.D. Protack, USMC

The NVG looks like something out of Star Wars.

IN any future conflict involving assault helicopters, night operations will undoubtedly be required in order to assure tactical surprise and mission accomplishment. Normal illumination, terrain and visibility requirements will make these operations difficult to coordinate and execute. A solution is the use of night vision goggles (NVGs). The AN/PVS-5 goggles are in use today; the ANVIS-6 goggles are now being operationally tested for future fleet use. Properly used, NVGs allow aircrews to conduct landing zone operations, or close-in fire support. NVGs yield a quantum leap in night operations capability, but if used improperly and without a thorough understanding of what they can and can't do, night vision can quickly become night fright.

Any fledgling aviator who puts on NVGs for the first time will probably be overwhelmed at the extra workload they impose on him. He will probably be amazed that anyone could safely fly using these Star Wars-looking binoculars. The goggles test the talents of any aviator during initial familiarization flights. You will probably not achieve a satisfactory proficiency level until you have about 20 to 25 hours of NVG time.

These early difficulties are well-founded. The AN/PVS-5 has a 40-degree field of view and 20/50 visual acuity. They reduce depth perception and significantly add to pilot fatigue because of their location on the helmet. Given these limitations, how do we safely fly using these goggles? The essential requirements are a common-sense understanding of the limits of NVGs and an established squadron SOP to govern their use.

The AN/PVS-5 NVG does look like something out of Star Wars. I have seen more than one aspiring Cobra pilot put NVGs on his helmet for the first time and take them off

A pilot models Night Vision Goggles. The parachute chords hanging from the goggles allow them to hang from his neck when not in use.

"Any fledgling aviator who puts on NVGs for the first time will probably be overwhelmed at the extra workload they impose on him."

immediately, demanding to know who thought up this example of fraud, waste and abuse. At first the goggles are tough to adjust and darn hard to simply apply to the helmet in less than five minutes.

Once on the helmet, the NVGs can be adjusted in three ways. Since the distance between everyone's eyes is different, an adjustable lever clamp allows maximum field of view and prevents divergence (crossed eyes). The binocular assembly also permits fore and aft movement of the tubes to ensure eye-to-tube clearance and tilting for proper eye-to-tube angle. Most important, the diopter ring on each tube allows corrections for nearsightedness and farsightedness, but not for astigmatism. The focus knob, also on the tube, is normally adjusted to infinity to correct for reduced stereopsis (the sense of depth perception that comes from seeing a slightly different image with each eye). With all these adjustments, NVG flying is a challenge. Improperly adjusted, your vision quickly resembles the same sight picture you receive after Happy Hour.

To properly use NVGs, a basic understanding of their inherent weaknesses is required. Besides the previously-mentioned 20/50 visual acuity, resolution is directly proportional to the ambient light available and is not as good as with the unaided eye. Distance detection varies proportionately with ambient light. Under low-light conditions (quarter moon) personnel can be sighted at 400 meters, stationary vehicles at 2,000 meters and moving vehicles at 3,000 meters. In medium- to high-light conditions (half moon or better) all identification parameters are greatly improved. For instance, major terrain features are recognizable at 16 kilometers in medium- to high-light conditions vice three kilometers in low-light conditions. In addition, depth perception is limited under all light conditions. At zero to 20 feet, perception is slightly less than normal. At 20 to 500 feet, depth perception is difficult. At 500 feet and above, depth perception is severly restricted.

Other limitations imposed on aircrews by the goggles come from cockpit lighting. By focusing to infinity in order to see outside the cockpit, close objects such as aircraft instruments are largely unreadable. An IR source is available for use on objects 6 feet or less. However, using this IR source may result in detection by threat forces. Cockpit lighting that is satisfactory to the unaided eye will wash out the goggles and restrict the aviator's vision outside the cockpit. During periods of low ambient light, cockpit lighting becomes especially critical and special care must be taken to tape over all cockpit lighting unless authorized blue-light kits are available. Another headache is windscreen glare, which demands that lights be kept at their lowest setting possible no matter what lighting scheme is utilized.

With all these constraints, how do we use the goggles safely? One of the key elements is an established SOP that definitively outlines their use. Abiding by a good SOP will be a key factor in avoiding that unscheduled impact with the ground we all fear. My squadron's SOP was the cornerstone of our 358.7 mishap-free NVG hours in 1985. Here are the basic rules we used successfully:

- The minimum lunar illumination is 20 percent, with 30 degrees moon elevation above the horizon.
- Each pilot will have flown four NVG hours in the last 90 days, and one hour in the last 15 days. One hour of NVG day filter time can be substituted for the 15-day requirement.
- The minimum altitude for contour flight is 50 to 200 feet.
- In order for both pilots to use goggles at the same time, both must have completed Phase II training, which involves low-level navigation, ordnance delivery and helo escort. If both pilots have not completed this phase then only one pilot may wear the goggles. Further, they are not cleared to terrain flight (TERF) altitudes unless the aircraft commander is a MAWTS-One certified NVG instructor.
- All NVG flights are listed as such on the flight schedule.
- Training routes away from home must be flown in advance on the day of the flight for hazard identification.
- No EVM/ACM is authorized.
- Intentional IMC flight is prohibited.
- All TERF currency requirements for day apply to NVG flights.

Phase lectures and pilot training by squadron Weapons Tactics Instructors (WTIs) and the ASO are provided to aircrewmen as they pass through the syllabus. During Phase I training (pattern work and navigation), we stress high ambient light conditions in a benign atmosphere free of excessive communications and traffic. These early flights provide a sound basis for Phase II training, which requires more detailed tactical planning and briefing that includes mission requirements, threat, ambient light level, weather, terrain and distance. At the cockpit level, crew coordination becomes more important as the pilot must be able to accomplish the necessary stick and rudder motions while relying on the other crew member for instrument information and navigation. Responsibilities vary with experience but should be discussed in great detail and clearly understood by all aircrewmen.

Proper understanding of how to use NVGs can give an aviator some of the most exciting flying he'll ever do. Abuse of SOPs and ignorance will provide unwanted squadron training: the activation of the Aircraft Mishap Board. There are mishaps that point to the risk associated with the use of night vision goggles. NVGs are a challenge under normal conditions, let alone during flights involving misuse and ignorance. All the up-to-date information on NVGs is available in the Assault Helicopter Manual. Understanding the valuable discussion in that text and going by the rules will make nighttime the right time when flying with night-vision goggles.

Capt. Protack is an AH-1T Cobra pilot with HMA 169. He is the squadron's aviation safety officer.

1st Lt. John Powell, USMC
VT 25

First Lt. Powell was undergoing CQ training aboard the USS *Lexington* (CVT 16). Following a hook-skip bolter, he was instructed by the Air Boss to commence a dirty bingo profile to NAS Key West. With no abnormal indications in the cockpit, 1st Lt. Powell began an immediate climb and headed his TA-4J for Key West, approximately 50 miles away. The lead safe joined and noted that 1st Lt. Powell's port main mount was cocked 90 degrees. After careful consideration and reference to the NATOPS PCL, he raised the landing gear and readied himself for a gear-up landing at NAS Key West. The nose gear and starboard main gear retracted fully, but the port main mount wedged against the forward wing root with the main gear door hanging below the two drop-tanks.

The arresting gear was derigged and with an LSO on station he flew *an actual instrument ASR approach* breaking out a 500 feet AGL. After circling to land, he executed a flawless intentional gear-up landing on the drop-tanks, resulting in less than Charlie damage to the aircraft. Prior to the CQ evolution, Lt Powell had studied a recent gear-up landing by a TA-4J detailed in the October 1985 Approach.* His preparation, along with his calm and analytical handling of this emergency were the subject of high praise by the lead pilot.

First Lt. Powell's professionalism and superb airmanship as a student naval aviator resulted in minimal damage to a valuable training aircraft.

*"Skiing Lessons From an A-4," by Lt. John W. Casey

BRAVO ZULU

LCdr. Dave Banks
Lt. Jerry Frazier
VQ 2

Ten seconds from touchdown on a night recovery aboard USS *Saratoga*, LCdr. Banks (pilot) and Lt. Frazier (navigator) experienced a sudden and complete lack of response to elevator inputs of their EA-3B. The controls stiffened dramatically, making fore-aft movement of the stick impossible.

LCdr. Banks, backed up by Lt. Frazier, immediately initiated a wave-off, applying military power and all available nose-up trim. The aircraft responded sufficiently to clear the ramp, skip and catch a four-wire for a successful arrested landing. Subsequent investigation revealed the surface control hydraulic pump drive shaft had disengaged, resulting in extremely high control input forces, and negligible pitch control response.

LCdr. Bank's and Lt. Frazier's immediate analysis and professional response saved seven lives aboard the Skywarrior, averted loss of the aircraft and prevented a major flight deck catastrophe. ◄

LCdr. Dave Banks (left), Lt. Jerry Frazier (right).

In Aircraft Mishap Investigations

Go the Extra Yard

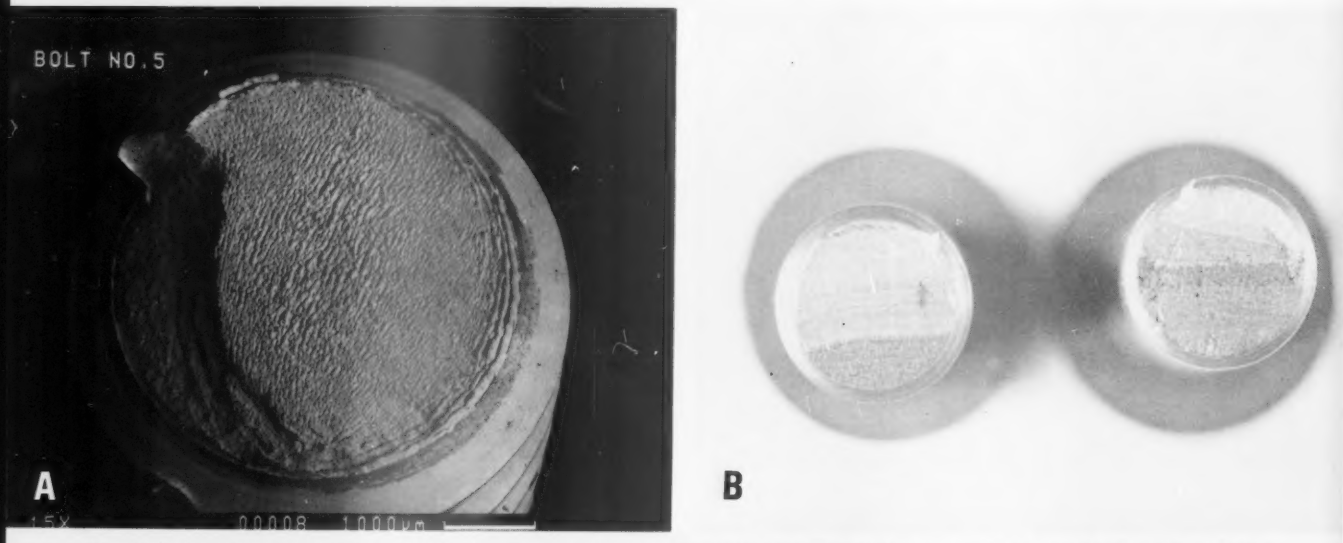
By LCdr. Jim Kline

AS an experienced aircraft mishap investigator at the Naval Safety Center, I've come to appreciate a lesson that I was taught early in my training: You don't stop until you have thoroughly examined *all* leads and evidence. Case in point: A little while ago I was sent to a foreign country to assist in a mishap investigation of a foreign-made helicopter. We were faced with many problems, such as a different language, foreign equipment and desert terrain. Nevertheless the "solution" quickly became obvious. Had we quit then, an accident would have actually remained unsolved.

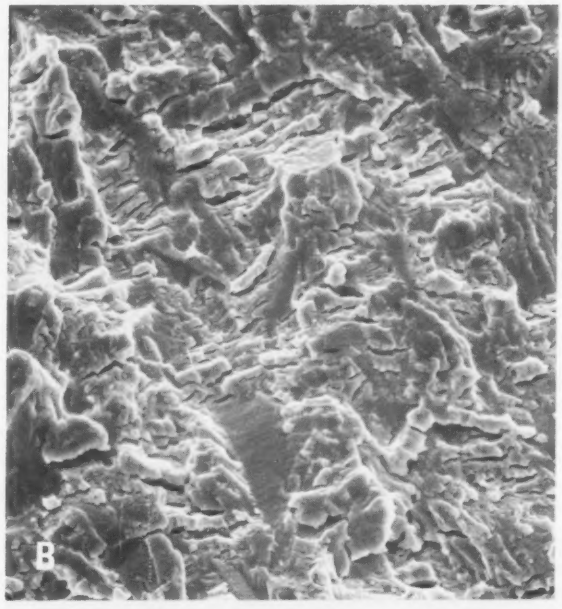
This particular mishap would remind me of the value of a thorough, complete investigation, and reemphasize the maxim that the quick or easy solution is usually neither. You must go all the way in completing the investigation, and *never* take the easy way out.

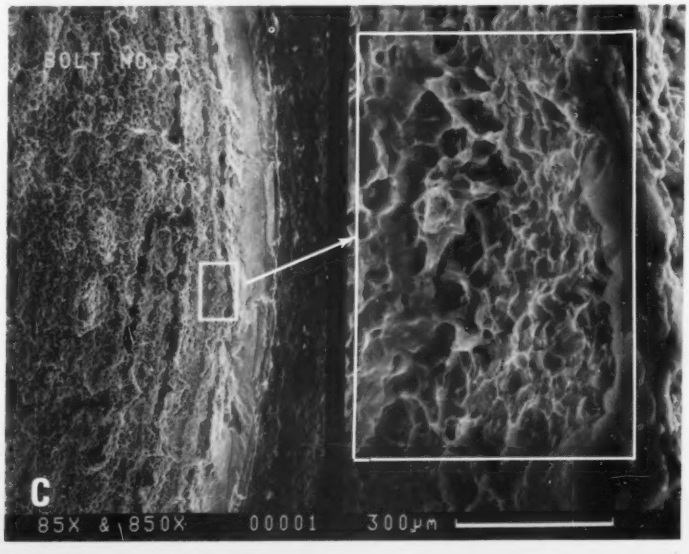
There we were, up to our boondockers in desert sand, looking at an unusual fracture surface on the helo's drive line, which transfers power from the engine to the rotor. Better get this to the lab for evaluation right away, I thought. *This could be it!* It sure looks like the classic fatigue failure taught at the Naval Postgraduate School. We sent it to a nearby lab where this hunch was confirmed. Case solved, retreat for a well-deserved beverage, right? Wrong.

One nagging doubt would not leave



Failed titanium bolt from helicopter crash showing an overall view of overstress fracture which initially appeared to be classic fatigue failure (A). Note similarity to actual steel fatigue failure (B).





Inspection by electron scanning microscope of failed steel bolt reveals fatigue failure (A). Compare enlarged view in (B) to enlarged area of (C), which is Titanium overstress.

my mind. What about the engine? I'd never seen one like that before. Was that compressor damaged, or did they all look like that? "You only want to go to another country," my fellow investigator teased, but nevertheless I persisted and got approval to have the engine investigated at the factory in "another" country, and to have the "proven failed" drive line component looked at by NAVAIREWORKFAC Southeast.

Well, you guessed it — the foreign research lab was wrong. No fatigue. They had been fooled by the fracture characteristics of the drive-line bolts. The bolts weren't steel like U.S. bolts, but titanium! Titanium overload fractures can and do look like fatigue failures of steel bolts. Suddenly, our "quick" solution evaporated. If we had quit out there in the desert, we would have botched the investigation hiding the true culprit.

Providentially, not all my luck had deserted me. The engine investigation prompted by only a nagging doubt paid off. Bearing failure, compressor case rub, loss of power, compressor stalls, all were proven. Whew! That was close!

The moral to this story is obvious, but bears repeating. Go the extra yard. Pursue all leads. When in doubt, there is no doubt. Don't give up. Believe me, it's worth the trouble to have a complete solution when the fat lady sings. ◄

LCdr. Kline is an E-2 pilot, currently assigned as an aircraft accident investigator in the Naval Safety Center.

Special Thanks to Mr. Warren Phillips of the Materials Laboratory, Naval Air Rework Facility, Norfolk, Va., for providing both photographs and technical assistance in preparation of this article. — Ed.

. . . Not finding the ship, the aircrew faced a dilemma. They now had 0+50 fuel. Going back to the beach was out . . .

We Lost the Umbilical

By Lt. Mark Mehling

IT had been an easy week. The LPH was ending its yard period with four days of sea trials just off the coast. The crew was looking forward to returning to the pier instead of the shipyard.

The air boss was happy. He had requested a single-spot waiver to land the ship's helicopter. It had been granted for day VFR, and everything was working out well. Everyone had been cautioned to start slowly, since it had been 10 months since flight ops had been conducted. In the first three days, more than 50 deck landings were performed, providing training to both pilots and deck personnel. All the training was paying off. One advantage of having the ship's organic helo on board was that realistic flight deck training was available. Another advantage was that the ship still had an umbilical cord to the beach. The 40 NM flight was relaxing to the aircrew, and it allowed the lucky few who could talk the XO into it to go ashore. Parts runs were the norm as the ship and shipyard worked feverishly to correct those last-minute discrepancies that plague all evolutions as large as ship overhauls. Ammo and smokes were also brought out to permit weapons and ship handling training. Having a helicopter was a real asset.

Of course, there had been a glitch or two but nothing of consequence. During the fly-out from the beach on the morning of the fourth day, the ship was actually 60 NM from NAS instead of the predicted 40 NM, but the aircrew established comms early on. Even though the ship's TACAN and radar weren't quite up to speed, they managed to get aboard after flying past the ship once. The ship was unable to refuel the helo because the JP-5 system had not been certified, so the crew wanted to conserve as much fuel as possible for the 1700 launch. Once aboard, 1+30 remained before reaching the SOP required 0+30 fuel reserve. Certainly enough to get to the beach.

During man-up for the 1700 pax drop to NAS, the high overcast was noted to have come down to 1,500 feet. The 5-degree dew point spread was eyed suspiciously,but the weather guessers predicted the dew point spread would remain the same until about 2400, a phenomenon common in the area. The launch would be slightly skosh because we were still 60 NM out. At UH-1N airspeeds and with any head winds, we were looking at a schedule of 50 minutes in/shutdown for fuel/50 minutes out to beat the 1930 sunset.

After launching on time, the pigeons call was as 050/72 NM. Still, if we continued to drive the ship North, we could expect to recover before dark.

The helo proceeded to the beach with no problem. The TACAN locked on easily to NAS, and a tail wind made the trip faster. To save time, the aircraft commander decided to refuel at the hot pits instead of shutting down. (The UH-1N has approximately two hours of fuel on internal tanks and 1+45 in the auxiliary tank. This "aux bag" must be gravity-refueled which requires a shutdown.) Although this meant only 2+00 to splash, it seemed more than adequate. After patiently waiting behind three H-3s and an S-3 with drop-tanks, the bird was on the go. The weather was now 1,500 overcast, but *time*, not weather, was the critical factor. It was now 1820 and sunset was going to be quick because of the solid cloud layer.

Heading outbound was routine with use of the UHF/DF to find the ship. There was enough fuel to fly back to the beach, if necessary, and at least the NAS TACAN worked. When the ship came up, they asked for and received the helo's bearing from the two TACAN stations, so the ship could give a bearing and range based on a plot of the ships position from the bridge and the helo position from the 2-TACAN crossfix.

Then it started getting interesting. The ship was 75 NM from NAS, steaming towards a mod lock position away from NAS. The aircrew discovered at 60 NM on the NAS TACAN that the UHF/DF feature wasn't working properly. Combined with increasing head winds, some of the options were running out. With no other means of navigation, the HAC accepted a ship-directed bearing and range based on DR plots.

Not finding the ship, the aircrew faced a dilemma. They now had 0+50 fuel. Going back to the beach was out. It appeared that none of the players knew *exactly* where either the ship or helo were. It was 1925 and getting dark fast. After another crossfix between TACAN bearings and ship's DR plot, a bearing and range was computed which put the helo over a fishing boat. The HAC was worried now, with the closest dry land 51 NM west. He agreed to try once more to locate the ship, then assume max range profile to the closest dry land. With 0+40 fuel remaining this was probably the best decision.

You can probably guess what happened next . . . but in case you can't . . . .

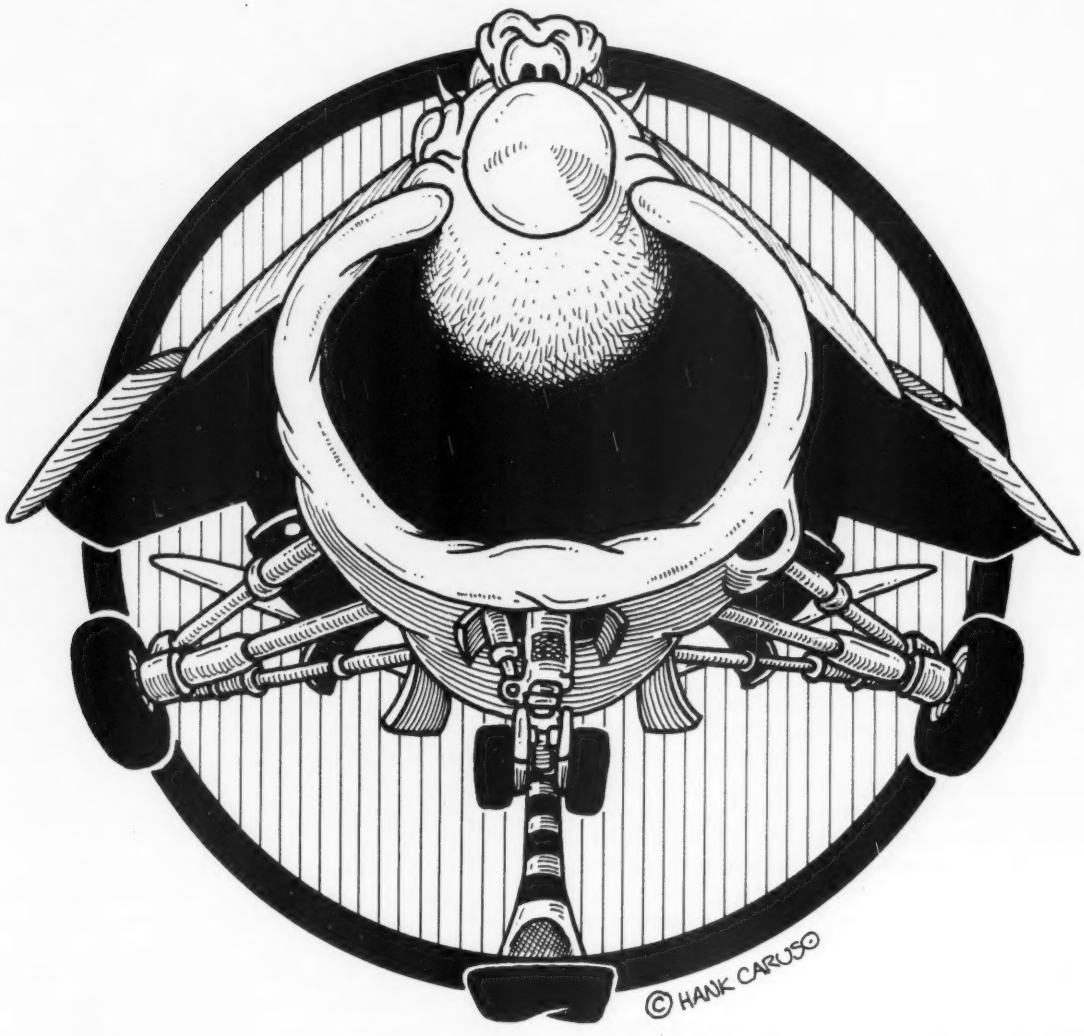
The entire story of this mishap-to-be ended, in actuality, at the beginning with the decision **not to launch**. Everything else from 1700 on was a conglomeration of what "could happen" or "might happen" to an aircrew at one time or another. What cancelled the launch? *Command support,* that vital factor that pilots envy, safety officers love and this crew enjoyed. The hop wasn't a necessity, and it didn't go. I hope, we'll never have to write the ending to this story — *will you!* ◄

Lt. Mehling is currently the safety officer aboard USS *Tripoli* (LPH 10). He has previously flown the SH-2F with HSL 32 and the SH-60B with HSL 41 as part of the SH-60B LAMPS MK III Fleet Introduction Team.

A Corsair Looks at Twenty

By A. "Sluf" Corsair

as told to Lt. Tom Ganse



TIME sure flies when you're having fun. Hard to believe, but next year I'll be 20 years old and still operational! Dad has got to be proud of me. I've grown a lot in those years. A bunch of people shook their heads and laughed at the idea of designing a "new" airplane by modifying a proven platform. Something had to be done quickly, and my cousin Crusader and I come from good stock; so here I am. Dad knew what he was doing even before I became just a sparkle in his eye.

Like everyone else, I went through my growing pains, mostly because I kept trying to do more than I could handle at

A-7A taxis on the deck of the aircraft carrier Ranger while another Corsair II flies off the ship's angled deck after missing arresting wires during training flights by VA 147, first A-7A squadron to go into combat in Viet Nam.

the time. I can't help it. The new engines helped, but you could say I went through puberty with the D/E improvements. I really am a lean, mean, attackin' machine now! Do the names Sidra, Syria and Grenada sound familiar? And those guys at China Lake are still looking for more things for me to try.

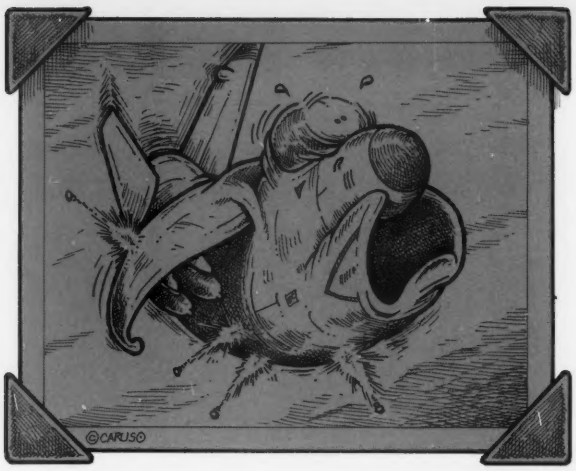
Yeah, I feel pretty good. I feel like I could last another 20 years, but some of my brothers haven't had such a good life. I've lost a lot of friends and relatives over the years. Some were heroes, some were unlucky, some were just plain stupid, but they're all dead now. I'm proud of those who died in dedicated service, but I really feel sorry for those who needlessly lost their lives because some jockey didn't know when to quit.

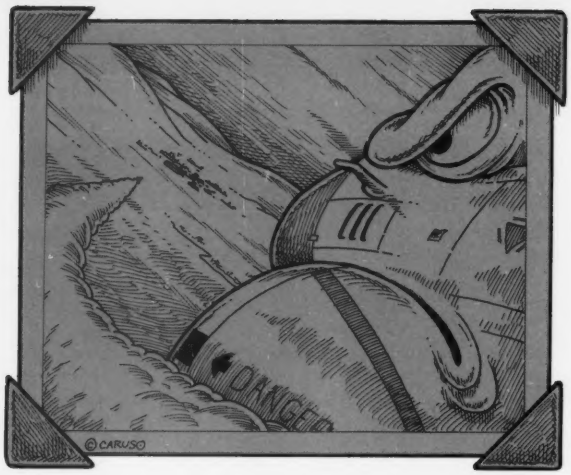
Now wait a minute. Didn't I just say something about "hacker" running in my hydraulic fluid? I wonder if maybe, just maybe, humans are like that, too. Naw. Can't be. They have brains. They're supposed to be able to think logically and rationally, and make sound, intelligent decisions. But trying to beat the record for low, fast flight doesn't sound like a logical, rational, sound or intelligent decision. I don't know anyone who has ever done more than tie it. Besides that, humans don't have hydraulic fluid.

I don't know. It's got to be something. These guys are still taking us out and beating us. I could take it when I was younger, but now that I'm getting on in years, my flaps are cracking, my skin is tearing, rivets and fasteners pop easier, and, well, years of getting beat against concrete and steel are starting to take their toll. I always told my pilots "You take care of me and I'll take care of you." And I'm a plane of my word, too. I remember swallowing a holdback fitting once during CQ. That guy knew what he was doing, so I just kept chuggin' and brought him back with the holdback still wedged in my compressor blades.

I can vividly recall many instances for me and my brothers that didn't end as happily. I mean, a plane can only take so much! But the pilots aren't the only culprits. I've seen my share of mechs turning wrenches, bending metal and wiping canopies. Still, I'm pretty impressed with the new breed. They can be a pretty sharp bunch of kids, but they're only as sharp as their leaders make them. I guess if I had any advice to offer here, it would be for the leaders to keep their standards higher than "acceptable." Even I, the '55 Chevy of tactical aviation, need good, quality maintenance if you want me to run like a high performance machine.

Hey — speaking of American Classics, have you seen the new kid on the block? Whatever happened to the old Detroit Iron of aviation — America's airborne tanks? Everyone's gone high-tech! I don't know about this Hornet guy. They say





he's sharp and agile — uses smarts and finesse to win a war. Well, I suppose that's progress. The kid's pretty young. He's got a lot to learn about taking care of pilots. Looks kind of fragile too, like an Indy car at the Friday night stock car races. But I suppose he's tough enough, or they wouldn't let him go out to sea.

I've been reading about some of his misfortunes. Funny thing, even with all the high-tech, high performance help, it's still the loose nut behind the stick that's causing most of the accidents. Let's give the kid a break! Do we have to re-invent the wheel with every new airplane? Seems to me a flight deck is still a flight deck and a wet runway is still a wet runway, no matter what kind of cockpit you're sitting in; so let's get on it, huh, guys?

Boy, I wasn't going to lecture, but I feel the wisdom of years creeping up on me. I guess I'm just tired of seeing "pilot error accepted" in the mishap reports. Why can't you do things like you were taught? The basics are the basics. Throwing them away is like taking the pilings out from under a pier. A good idea is only a good idea if it is founded on accepted principles and techniques, both of which have probably been written in blood. Published procedures are lessons learned. Dad didn't just build me and say, "Have at him boys!" He made sure there was adequate testing and research to make me predictable. Too bad your dads didn't do that with you.

OK, OK, I'm not going to win any points by getting personal. Do me a favor. Take it from someone who's been there — straight from the Corsair's intake. Every day, we put our fates in your hands: the pilots, the supervisors, the wrench-turners. Airplanes don't kill people and they don't break themselves. When we are operated according to our specifications and within our limitations, we'll bring you back. And if we do screw up, you've got a seat! We'll pay the price. But if my parts are installed wrong, or you get ham-fisted or ignore the rules, you're gonna break me. You may or may not save yourself, but you're gonna break me.

Look around you. How many Corsairs do you see? Guess what — that's all, folks. There aren't any more where those came from. Oh, sure, you say there are other airplanes to fly — if you want to wait around long enough. Why wait if you could be flying now?

And as for the rest of you jet jocks, rotor heads and prop types, don't think this doesn't apply to you. Ever since Orville spun his biplane, we've been wise to your ways. People aren't going to just keep buying you new toys if you don't take care of the ones you've got. Use us or lose us, but don't abuse us.

Lt. Ganse is an A-7E pilot with VA 94. A graduate of Penn State, he served in VT 7 as an advanced jet instructor.

LETTERS

Re: Sign Strike (April '86)

FPO, New York, N.Y. — On April 16, 1982, I was a student in the training command and flew my first hop in the TA-4J, a BI-9. As I was preparing to "walk," a classmate who had just flown his BI-9 came into the ready room. He looked rather pale. Several fellow students asked what had happened to this fledgling SNA.

It turned out that he and his instructor, a cruise-experienced aviator and LSO, had hit the trees while executing a missed approach on a practice GCA to runway 19 under VFR conditions.

The chain of events that contributed to the accident in "Sign Strike" were nearly identical. After the April 1982 mishap, station personnel cleared trees and vegetation from the hill located under the final approach corridor to runway 19. Now it appears signs are growing in the corridor; however, the sign probably was not at fault.

Aircrews must thoroughly familiarize themselves with all aspects of an airfield, particularly homeplate. Further, appropriate measures should be implemented to ensure that this hill north of runway 19 right does not appear in another issue of Approach. This is at least the second time this hill has contributed to the damaging of a valuable government asset. Next time Uncle Sam may be paying SGLI benefits to the aircrew's families.

Capt W.R. Godwin, USMCR
VMFA 314

• There's some confusion here. The aircraft involved in the sign strike was making a practice approach to runway 1R. Records show that the aircraft that struck the trees on GCA missed approach back in April 1982, actually made his approach to runway 19L vice runway 19R. And yes, it did occur in day VFR conditions. In addition to trimming the treeline, the glide slope for the 19L approach was raised from a 3.0 degree angle which already met TERPS criteria to 3.25 degrees. We are told that approach criteria for runway 1 are currently under review. — ACCM Frank McGee, Air Traffic Control Analyst, Naval Safety Center.

Re: Believe It or Not, It's Thunderstorm Season Again (April '86)

Hampton, Va. — Since 1980, the NASA Langley Research Center has been conducting the Storm Hazards Program. We have a specially-instrumented and lightning-hardened F-106B craft that is flown into thunderstorms in order to study the electromagnetic characteristics of lightning and the atmospheric conditions conducive to lightning strikes to aircraft. I have been the project and flight test engineer on this program since its inception and have published several papers summarizing the results of our program.

Therefore, it was with great interest that I read the article on thunderstorms. It states that statistics show that flying at the freezing level will increase the odds of experiencing a lightning strike. This statement is at variance with the results of our program. Based on 690 lightning strikes encountered between 1980 and 1985, our results were:

- The peak strike rates occurred at pressure altitudes between 38,000 and 40,000 feet, corresponding to ambient temperatures colder than -40 degrees Celsius. The peak strike rate at the freezing level (0.1 strikes/min) was an order of magnitude less than the rate at -40 degrees Celsius (1.4 strikes/min).
- Direct lightning strikes were encountered at nearly all temperatures and altitudes in the thunderstorms.
- The presence and location of lightning does not necessarily coincide with the presence and location of hazardous precipitation and turbulence. In addition, hazardous precipitation and turbulence are not necessarily related to one another.

The discrepancy between the strike data used in the article and those published by NASA probably can be attributed to the fact that at the higher altitudes (25,000 to 40,000 feet), jets usually deviate around thunderstorms, whereas at the lower altitudes (10,000 to 15,000 feet), deviations are more restricted by the need to depart or approach the airfield and by ATC restrictions. In addition, circumstantial data indicates that many strikes to aircraft occur near the freezing level in stratiform rain, whereas all of the NASA data was gathered in active thunderstorms.

In summary, cautioning aircrews that the most likely place to be struck is near the freezing level is based on incomplete data and, therefore, is misleading.

Bruce D. Fisher
Aero-Space Technologist
NASA Langley Research Center

Approach welcomes letters from its readers. All letters should be signed though names will be withheld on request. Address: Approach Editor, Naval Safety Center, NAS Norfolk, VA 23511-5796. Views expressed are those of the writers and do not imply endorsement by the Naval Safety Center.

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Poster idea contributed by ADAN Reilly, VAW 116